THE SHORT-RUN SHIFTING OF UNIT TAXES WITH SPECIAL REFERENCE TO THE PROCESSING TAXES LEVIED UNDER THE AGRICULTURAL ADJUSTMENT ACT

BY

LELAND JAMES PRITCHARD

B.A., Cornell College, 1929

M.A., Syracuse University, 1930

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ECONOMICS IN THE GRADUATE SCHOOL OF THE UNIVERSITY OF ILLINOIS, 1941

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SCOPE, METHOD—GENERAL CONCLUSIONS OF THE STUDY

This study endeavors to formulate the general principles of unit tax shifting in such a way that they can be of value as guides to fiscal policy. The study is based upon the premise that if theoretical conclusions are to be of significant value to the tax administrator, it is necessary to take cognizance of the non-competitive elements affecting tax shifting; and to analyze the effects of a tax in terms of the short-run reactions of particular firms within the industry.

SCOPE

The scope of the thesis has been dictated by the ordinary requirements of a theoretical-statistical study, viz., the formulation of hypotheses and the testing of these by observation of the actual phenomena of economic life. Accordingly the study is divided into two main divisions: Part I is concerned with the *prediction* of unit tax shifting under certain assumed conditions; while Part II *measures* the shifting of some of the processing taxes levied under the Agricultural Adjustment Act.

The theoretical phase includes an analysis of the short-run shifting of specific and ad valorem taxes under conditions of pure competition, joint demand, joint supply, monopoly and imperfect competition. One section is devoted to an analysis of the effect of price discrimination under monopoly upon tax shifting, and another section points out some modifications and interpretations of pure theory if it is to be used as a guide for public policy. A special note is also included on the relation of elasticity of demand and equilibrium price under conditions of monopoly and imperfect competition.

The statistical phase of the study is divided into two parts:

(1) A general appraisal of the methods by which the United States Processing Tax Board of Review has essayed the task of measuring the shifting of the processing taxes; and a critical analysis of certain selected cases adjudicated by the Board.

(2) An analysis of the shifting and incidence of the hog and wheat processing taxes in terms of the entire industries engaged in the production and distribution of these products.

METHOD

An attempt was made in Part I to fill in the theoretical forms with a hypothetical content. Accordingly all the various cost and revenue curves and other assumptions relied upon were given, wherever possible, a definite factual basis. While the theoretical conclusions were generally much broader than the factual material introduced, the use of tables, accompanying charts and related techniques provided important checks on much of the analysis.

By thus definitizing the analysis it was discovered, for instance, that the effect of an ad valorem tax is to *maintain the same degree of elasticity* in the ad valorem supply curve as existed in the previous supply curve at corresponding ordinates viz., ordinates having the same abscissa; while the specific tax results in a new supply curve which is uniformly *more elastic* at corresponding ordinates in comparison with the old supply curve. If, therefore, the amount of the specific tax is a percentage of the pre-tax equilibrium price which is equal to the rate of the ad valorem tax, the specific tax will result in a greater reduction in output and a larger increase in price as compared with the ad valorem tax. The significance of using these more precise techniques is emphasized by the fact that the above conclusion is the exact opposite of conclusions reached in previous studies in which these relationships were discussed.

Reliance in Part II was largely placed upon the Refund and Unjust Enrichment Provisions of the Revenue Act of 1936, the Reports of the United States Processing Tax Board of Review and on the excellent study prepared by the Bureau of Agricultural Economics entitled *An Analysis of the Effects of the Processing Taxes Levied Under the Agricultural Adjustment Act.* In the analysis of the shifting of the processing taxes in terms of an entire industry no significant departure has been made from the methods and data used by the Bureau. A wider application, however, has been made of the coefficient of elasticity to supplement or corroborate the margin technique, and some additional material relative to cost changes and profit margins has been introduced to throw additional light on the extent and nature of the burden of these taxes.

GENERAL CONCLUSIONS OF THE STUDY

PART I

Pure Competition

1. A unit tax irrespective of its size will always (theoretically) result in an increase in price and a decrease in output, since a finite tax must necessarily cause a finite shift in the marginal cost curves of the individual firms and therefore in the supply prices of the entire industry. All firms reduce their outputs at their *intensive* margins, while the so-called "marginal firms" (in the *extensive* sense of that term) leave the industry; but an exodus of firms is not necessary in order that shifting occur.

2. Unless demand were perfectly inelastic, or supply perfectly elastic, the increase in price as a consequence of the imposition of a unit tax will always be less than the amount of the tax. This conclusion is not affected by the fact that the ad valorem tax may be calculated on the gross selling price rather than the selling price net of the tax.

3. If a given firm in the industry is producing under conditions of short-run increasing costs (i.e., average total unit costs increase as output is expanded, within a period of time too brief to allow of any change in the *scale* of the plant) the imposition of a unit tax will result in a larger proportion of the tax shifted per unit of output from the private standpoint (i.e., by taking account of changes in the firm's unit costs induced by the tax) than from the public standpoint (i.e., by taking account of changes in selling prices only); and the converse is true if the firm is operating under conditions of short-run decreasing costs.

4. If the amount of the specific tax is a percent of the pre-tax equilibrium price which is equal to the rate of the ad valorem tax, the specific tax will cause a greater decrease in output and a higher equilibrium price than will the ad valorem tax.

5. If the amount of the specific tax and the rate of the ad valorem tax are so adjusted as to produce an equivalent increase in price under a given demand situation, any increase in demand

(demand is used in the schedule sense) will result in a higher equilibrium price under the ad valorem tax than under the specific tax; and the converse holds if demand should decrease.

Joint Demand (competition assumed)

1. If a unit tax is imposed upon one of two commodities necessarily used jointly, an equal curtailment in the purchases of the untaxed as well as the taxed commodity will ensue, the price of the taxed commodity will increase, but by an amount less than the tax; and the price of the complementary (untaxed) commodity will fall, but not by a compensatory amount. The relative increase in the price of the taxed commodity will be greater, and the decrease in the price of the untaxed article less, the more inelastic (or less elastic) the joint demand.

2. If the specific tax is a percentage of price which is equal to the rate of the ad valorem tax, the ad valorem tax will cause a relatively smaller increase in price of the taxed commodity under either a relatively elastic or inelastic joint demand as compared with the specific tax.

Joint Supply (competition assumed)

1. That commodity, of several commodities jointly produced, will increase relatively more in price whose demand schedule is more inelastic (or less elastic) as compared with the demand schedules of the other commodities, irrespective of the commodity upon which the tax is formally levied.

2. The use to which the tax funds are devoted will not affect in any way the extent to which the tax is shifted through the price of any particular commodity, unless the effect of such expenditure is to alter the comparative elasticities of the demand schedules of the several commodities.

3. The comparative effects of the specific and ad valorem taxes are in general the same as those enumerated under pure competition.

Monopoly

1. The effect of a unit tax is always (theoretically) to raise price, and usually by something less than the full amount of the tax. Only when the marginal cost curve is falling faster than

the firm's average revenue curve (under the specific tax) or the derived marginal revenue curve (under the ad valorem tax), or when the average revenue curve is sufficiently concave (with respect to the X axis) will the rise in price equal or exceed the amount of the tax.

2. If the amount of the specific tax is a percentage of the pre-tax equilibrium price which is equal to the rate of the ad valorem tax, the specific tax will result in a higher equilibrium price and a larger decrease in output as compared with the ad valorem tax.

3. If the specific tax and the ad valorem tax are so adjusted as to produce an equivalent increase in price under a given demand situation, any increase in demand will result in a higher equilibrium price under the specific tax then under the ad valorem tax; while the converse is true for any decrease in demand.

Price Discrimination (monopoly assumed)

Short-run equilibrium, where price discrimination is involved, obtains when the firm's marginal revenues in the several markets, as derived from the average revenue curves for these respective markets, are equal to each other and to the marginal cost of the firm's entire output.

1. If the amount of the specific tax is a percentage of the average pre-tax equilibrium price which is equal to the rate of the ad valorem tax, the specific tax will result in a higher average equilibrium price and a larger decrease in output than will the ad valorem tax. (Averages are weighted by the quantities sold in the several markets.) This is not to imply, however, that a specific tax thus defined will result in a higher equilibrium price in any given market as compared with the ad valorem tax.

Imperfect Competition

Theoretical conclusions are of doubtful validity if they are based upon assumptions that depart materially from the actual conditions surrounding the particular levy. Therefore a satisfactory theory of unit tax shifting cannot be developed by

shifting from the assumptions of pure competition to those of pure monopoly ,as has heretofore been done. Short-run theories thus far formulated of unit tax shifting under conditions of imperfect or monopolistic competition are, in reality, monopoly theories. An effort has been made to correct this particular deficiency in this section of the study. This section thus constitutes an entirely new theoretical approach to the problem.

The average revenue schedule of the individual firm has heretofore been defined (in tax shifting analysis) in such ways as to preclude a distinct theory of unit tax shifting under imperfect competition. Two types of *objective* average revenue schedules have been defined: (1) that the firm's average revenue schedule is a *fractional part* of the demand for the general class of product produced by the industry; and (2) that the firm's average revenue schedule is a separate *species* of demand curve, which represents a schedule of the quantities of the firm's product which can be sold at various prices providing competitors' prices remain fixed. The principal reason for rejection of the first type of schedule is that it rules out product differentiation; the second is ruled out because it denies that rivals as well as the given firm make adjustments in their outputs as a consequence of the imposition of a unit tax, viz., that they seek to maximize their profits.

In contrast to these a *subjective* average revenue schedule is here assumed. It is conceived as discounting the full effects, direct and indirect, of the alteration in the competitive relationships of the firm as a consequence of the imposition of a unit tax. As such it constitutes a separate species of demand curve and is uniformly more elastic at corresponding prices than is the demand schedule for the general class of product.

Since the position and slope of the given firm's average revenue curve is in part determined by the level of competitors' prices, and since competitors' prices are not assumed to remain fixed, there can and does take place as a consequence of the tax a series of shifts or oscillations in the given firm's average revenue curve. Theoretically these movements continue until the subjective curve becomes *objectively correct,* i.e., equilibrium is attained.

Using the subjective concept of the average revenue schedule, conclusions are as follows:

1. The more elastic the average revenue curve of the individual firm the smaller the proportion of the tax shifted (*ceteris paribus*); and the more elastic (or less inelastic) the demand for the general class of product, the smaller the upward shifts of the average revenue curves of the individual firms and the smaller the proportion of the tax shifted; and the converse is true the less elastic these several curves.

2. If the point of maximum profits is on the rising phase of the marginal cost curve before the tax, the steeper the slope of the curve, the smaller the proportion of the tax shifted; while if the point of maximum profits is on the declining phase of the marginal cost curve the steeper the slope the greater the proportion of the tax ordinarily shifted.

3. The general comparative relationships of the specific and ad valorem taxes as described under monopoly also apply to imperfect competition.

PART II

The Measurement of the Shifting of the Processing Tax by the Individual Firm

The United States Processing Tax Board of Review is the administrative agency charged with the responsibility of determining the shifting of the processing taxes. Basic procedures governing the Board are set up in the Refund and Unjust Enrichment Provisions of the Revenue Act of 1936. This statute (which superseded section 21 (d) of the Agricultural Adjustment Act, as amended August 24, 1935) provides the first instance in which tax shifting measurement is treated as an economic rather than as a legal problem.

It is believed, however, that too much reliance is placed on the margin method. The statute defines the margin as the differenec between the cost of a unit of the raw material, plus the processing tax, and the current sales value of all the products obtained therefrom. The *prima facie* measure of tax burden absorption is then given by the decline of the net margin (exclusive of the tax) in the tax period as compared with the base (untaxed) period. The processor or government is allowed to

introduce rebuttal evidence that other factors, such as increased processing costs (i.e., wages, taxes, interest, etc.) were responsible for a designated portion of the increased spread in the gross margin.

The margin method is not capable of entirely dissociating the effects attributable to a tax from those phenomena reflecting changes in the multitude of other economic forces impinging upon the individual firm. As such it requires supplementation. There is need to analyze the *causes* for price and cost changes. It is axiomatic that unless these changes are directly attributable to the imposition of the tax, or the expenditure of the tax funds, they are not admissable as evidence of shifting or non-shifting.

The margin method would not require supplementation if one price series responded exactly like a second series to all the factors bearing on the second and reflected, in addition, the special influence of the tax. Since the price data on which the Board is forced to rely do not meet this test, the accuracy of their findings would be considerably improved in many instances by an analysis of unit costs over time and over a range of outputs, and by a critical examination of the causes of demand shifts. Other difficulties of serious import in the determination of tax shifting relate primarily to the securing of adequate data. These difficulties can only be remedied by a revision of the accounting and reporting practices of the firms subject to the Act.

The Industry-Wide Shifting of the Hog and Wheat Processing Taxes

The margin method, as applied to the individual firm, does not provide the basic data necessary to the formulation of a sound tax policy. It cannot be inferred from the data thus assembled whether the tax burden is shifted forward or backward, nor can it be ascertained through what particular products or costs the tax was shifted. For even an approximate determination of the ultimate incidence or burden of the tax it is necessary to go beyond the individual firm; to study the shifting of the tax by the entire industry; and in many instances to pursue an even broader inquiry.

The Shifting of the Hog-Processing Tax

Calculations of average elasticity of (statistical) demand for

hog products for the period 1925-1936 yielded a coefficient of —0.94. For the tax years 1934 and 1935 the coefficient was slightly greater than unity. Such an elasticity of demand combined with the fact that the short-run supply of hogs is relatively inelastic and that the tax constituted a relatively large proportion of the selling price ($2.25 per 100 pounds liveweight) suggested that the tax was probably shifted *backwards* to the producers. This assumption was corroborated by the Bureau's analysis of cash farm income from the sale of hog products and by a comparison of processors' and distributors' unit margins.

The Shifting of the Wheat-Processing Tax

The wheat-processing tax provides, on the other hand, an equally clear-cut example of *forward* shifting. Calculations of average elasticity of flour for the period, July 1924-June 1935, yielded a coefficient of —0.04. For approximately comparable periods Henry Schultz obtained an average coefficient of elasticity for wheat of —0.21; and Holbrook Working, of —0.24. Since flour constitutes approximately 70 percent of the aggregate wheat mill products it follows that the demand for flour is much more inelastic than is the demand for the other mill products (i.e., bran and middlings). The extreme inelasticity of demand for flour and the fact that the tax constitutes such a small proportion of the selling price of bread (approximately 0.5 cent per one-pound loaf) suggested that the tax was probably shifted forward through the prices of flour and bread.

These tentative conclusions were corroborated by the Bureau's margin analyses. A comparison of Chicago and Liverpool prices indicated that the slight (approximately 3 percent) decreased consumption of wheat in the United States, as a consequence of the tax, had no material effect in lowering world wheat prices. A comparison of the spread between the prices of wheat and mill products at Minneapolis and Winnipeg indicated that the tax was largely shifted through the price of flour; while additional comparisons of the spread between wholesale and retail flour prices an dthe spread between wheat prices and the comparable retail prices of flour and bread indicated that the tax was further shifted forward and that its ultimate incidence was largely upon the consumers of these commodities.

VITA

Leland James Pritchard was born at McClelland, Iowa, February 20, 1908. After graduation from the Dunkerton, Iowa, consolidated high-school in 1925 he entered Cornell College. He received the degree of Bachelor of Arts from that institution in June 1929, with a major in political science. The following September he entered Syracuse University as a teaching fellow in political science, and received the Master of Arts degree from that institution in June 1930. From September 1930 to June 1932 he was a part-time instructor in political science at Syracuse University. Graduate work during this yeriod was in the fields of economics and political science. Graduate studies in economics and statistics were pursued at the University of Chicago from September 1932 to June 1933. From July 1933 to September 1933 he was a statistician for the Illinois Emergency Relief Commission; from September 1935 to July 1937, assistant coordinator of statistical, research and survey projects, Works Projects Administration (Ill.); and from July 1937 to February 1938, public administration consultant for the same organization. He was appointed assistant professor of economics and statistics at James Millikin University from February 1938 to February 1939 while a member of the staff was on leave of absence. Since February 1939 he has been an assistant in economics at the University of Illinois.